



MISSOURI DEPARTMENT OF NATURAL RESOURCES

Establishing and Managing Warm-Season, Native Grasses on Reclaimed Minelands

Fact Sheet

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Division of Environmental Quality
Land Reclamation Program

Warm-season, native grasses (WSNGs) play a crucial role in abandoned mine land (AML) reclamation. They have greater tolerance of acidic, droughty and low fertility soils than do most introduced, cool-season grasses. WSNGs produce excellent forage if managed correctly on good reclamation sites. WSNGs provide excellent wildlife habitat on all AML sites. WSNGs are long-lived once established and managed correctly. Trees can quickly invade WSNGs stands without the use of fire. Improper haying or grazing practices can quickly destroy a stand of WSNGs.

A significant problem with WSNGs is that establishment is slow and the seeds are difficult to plant due to their hairy or bearded seed coats. They require special planting equipment to handle the bearded seeds and plant them at the appropriate depth with proper seed-to-soil contact. WSNGs initially grow downward, building an extensive root system that enables the plants to survive harsh, dry soil conditions so common on the prairie during August and September. Shoot growth is minimal during the first two years, giving the appearance that the stand has failed. WSNGs appear small and weak in the first year, but by the third year they develop into robust, mature plants. Once the root system is established, WSNGs can endure severe drought, low nutrient levels and acidic minespoils. Patience is necessary in establishing native grasses. The Missouri Department of Conservation and the Natural Resource Conservation Service provides publications and assistance to help landowners and managers identify native grasses.

Green Manure Crops

The best method to establish WSNGs includes planting green manure crops in the minesoil for several growing seasons prior to WSNG planting. Green manure crops are plantings of quickly established, fast-growing cereal grasses and legumes that are turned into the soil while they are green, hence "green manure." This is an old agricultural practice used to improve the soil's tilth, infiltration rate and water-holding capacity. Incorporating legumes into the mix adds nitrogen, which promotes the development of a soil biological system, resulting in improved nutrient cycling. Multiple seasons of green manure crops increase the length of time that beneficial soil microbes and fungi have to colonize a reclamation site. This may be especially important because it may take five to seven years for mycorrhizae to colonize a drastically disturbed site. (Refer to Technical Assistance Bulletin #3 for a discussion of the importance of mycorrhizae and native grasses.)

Warm-season native grasses and forbs should be planted in the spring. WSNG seed planted in the fall may germinate during an Indian summer, making the immature seedlings susceptible to frost heaving and winter kill. WSNGs can be frost-seeded in winter, but erosion may remove seed from an unprotected site. The site can be protected from erosion by planting a green

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manure crop of cereal grasses and legumes. Cereal grain grasses should be mowed before their seeds ripen to limit self-seeding.

Heavy mulch may be applied to protect the site from erosion. The mulch can be native prairie hay or cereal straw free of weed seed or cool-season grass seed such as fescue. Old hay that is unfit for livestock may be used because the goals are site protection and the incorporation of organic matter. Do not apply and incorporate more than five tons of mulch per acre per year.

A summer-planted green manure crop of milo, corn or sorghum-sudan grass, planted with a legume like common lespedeza, soybeans or hairy vetch, can be useful in protecting the reclamation site from summer storms. This should be turned into the soil in late summer and a second green manure crop of wheat and a legume planted. In this fashion, two green manure crops can be worked into the reclamation soil prior to planting WSNGs.

In the spring before the planting, the green manure crop or mulch must be turned into the soil by disking to increase the organic matter content. Soil tests should be taken and the soil top-dressed at the time of disking. Never should more than 30 pounds of nitrogen per acre be applied for WSNG establishment, regardless of soil test recommendations. Excess nitrogen stimulates weedy competition.

Native grasses can be directly no-till drilled into wheat stands later in the spring. However, there is a risk that the wheat could out compete the WSNG seedlings for water and sunlight. Mowing before the seed heads ripen may be necessary to limit the wheat reseeding itself.

Seed Quality

The seed should be purchased from a certified seed dealer and free of noxious weeds. Warm-season native grass must be purchased on a pure live seed (PLS) basis. PLS equals the purity of the seed times the germination and firm seed percentage and ensures that the seed is viable and of high quality. Seed should be stratified for immediate germination upon planting. The seed dealer must certify seed purity and that the seed is free of contamination by old world bluestems. The addition of prairie forbs to the seed mixture provides structural diversity and multiple sources of food for wildlife. Forbs are not purchased on a PLS basis. Forb seeds can be expensive and the reclamation budget may limit the number of species in the mixtures. Debearded big bluestem and Indiangrass seed is available but costs 20 to 25 percent more than bearded seed. A traditional grass drill can be used to plant debearded seed. (For an example of a diverse WSNG and forb seed mixture for Missouri see attachment II.)

Methodology

The seedbed should be firm. Cultipacking may be required in loose, sandy or dry soils. The seed in the drill hoppers must be thoroughly mixed to ensure adequate distribution of seed that will result in the proper stand diversity. A specifically designed native-grass seed drill is far and away the best tool to establish a successful and diverse stand. Grain drills or cool-season grass drills "adapted" to planting natives perform poorly. The Missouri Department of Conservation, the USDA Natural Resource Conservation Service and local soil and water conservation districts can assist landowners in locating native grass seed drills.

Good seed-to-soil contact and proper planting depth are necessary for WSNG seed germination and development. The seed should be placed no deeper than one-quarter (1/4) inch (controlled by depth bands) and pressed firmly into the soil by press wheels. If the seed is deeper than 1/4 inch, the seed leaves may be able to penetrate through the soil surface. Gamagrass can be seeded up to one inch in depth. Expensive WSNG and forb seed is wasted if improperly

planted. Cutting corners with poor quality seed or using inferior planting methods is bad management and will greatly increase costs to the landowner or manager.

WSNG planting on minesoils should be completed between March 15 and May 30. Planting after May 31 increases the risk that inadequate summer rainfall will result in excessive seedling mortality. This is especially true for droughty, AML mine spoils. Late planted seedlings with poorly developed root systems can be lost to winterkill or frost-heaving.

A successful first-year reclamation planting should have a minimum of one WSNG plant per square foot by September 1. If this density is not present, the weak areas should be reseeded the following spring. Wheat or mulch can be used on the bare areas for temporary overwinter protection. When direct, or no-till seeding, it is important to use a seed drill with a trash rack or blade that cuts straw or mulch rather than pressing it into the soil. Crimped organic litter ("trash") and straw acts like a wick, drawing moisture away from the seedbed and the germinating seed.

The warm-season grass stand will look very weak, perhaps weedy, in the first season. Do not be discouraged by this appearance. It takes only one WSNG plant per square foot to grow into a closed canopy in three years. Warm-season grasses expend most of their energy developing rhizomes and growing roots deep within the soil during the first two years. The soil protects the roots and rhizomes from sudden environmental change on the harsh prairie. A six-inch-tall big bluestem seedling may have a four-foot-deep root system extending over an area of one foot in diameter. There may be only a few leaves scattered in small clumps. The ground may be mostly barren, but roots and rhizomes are extensive in the first year, making the site far more resistant to erosion than a casual observer would suspect. The thick, extensive woody roots and rhizomes of WSNGs and forbs are adaptations to Missouri's periodic droughts. As with oaks or hickories, survival under these conditions forces plants to develop extensive root systems and a physiology that places a premium on drought and low-nutrient tolerances. These conditions are common on drastically disturbed lands. Rhizomes enable WSNGs to spread following drought. Unlike the shoots that die every year, the roots and rhizomes are the perennial living parts of prairie plants.

Perennial ryegrass is a short-lived, cool-season grass that plays a significant role in early establishment of the WSNG stand. It is quickly established following seeding. The result is a closed ground cover for both aesthetics and erosion control. Perennial ryegrass planted at a low rate (never more than three pounds PLS/acre) is not overly competitive, allowing the native grass to germinate and grow through and above the shorter perennial ryegrass. Perennial ryegrass will persist only two to three seasons. Thus, when the ryegrass is dying out in the third year, the native grasses should experience rapid shoot growth.

Reclaimed mine soils rarely have a large weed seedbank, and therefore weeds usually do not threaten WSNG establishment during the first season. Ragweed, cocklebur and other tall weeds can shade out WSNG seedlings. By the second growing season, more weeds will invade the mine site, but the WSNGs should not be greatly affected. Annual weeds can be mowed in May of the second growing season if it appears the weeds are excessive. The mower should be set at 12 inches to miss the grasses and forbs. The site must be protected from grazing during the second year because the WSNGs are still developing their root systems. The site should not be hayed the second year because that can inhibit root and shoot growth the next season. Mowing and grazing reduces photosynthesis, which in turn reduces the production of carbohydrates. WSNGs must be allowed to recharge their carbohydrate reserves to prepare for winter and to grow well the following season.

Burning

In the spring of the third year, the warm-season grass stand can be burned by the landowner or manager to promote maximum shoot growth. Burning releases some nutrients in the ash and allows sunshine to warm the soil and begin new growth earlier in the spring. Burning also promotes development and flowering of the prairie forbs, enhancing diversity and the beauty of the stand. Burning greatly improves wildlife habitat. Technical assistance in planning the burn can be obtained from the local Natural Resource Conservation Service office, local extension offices, the Soil and Water Conservation District and state wildlife conservation agencies. The site can be lightly grazed or hayed in the third year if the stand is robust and thriving. However, cattle should not be allowed to graze, nor should the grass be cut for hay after August in the third year. This will allow WSNGs to replenish carbohydrate reserves for the next growing season. Removing organic matter in the third year will retard the natural reclamation process and will slow the closure of the WSNG stand.

Managing WSNGs for Wildlife

Burning plays a major role in maintaining a WSNG stand and promoting wildlife habitat. Burning removes thatch and dead plant litter. This warms the soil more quickly in the spring and promotes the growth and development of prairie forbs. Many important legumes need fire to create conditions for regeneration by seed. Legumes and forbs are high-quality food sources for wildlife. Illinois bundleflower, partridge pea, common lespedeza and compass plant support a great many insects that in turn are consumed by other wildlife.

Native grasses provide excellent canopies for young animals to feed and take cover under. Cold, wet summer mornings can be fatal to quail or turkey chicks. Native grass stands can have enough open areas for the chicks to sun themselves during such weather.

Warm-season native grass stands promote natural succession on mine sites. Native grass stands are susceptible to woody plant invasion without fire. Trees and shrubs find niches of bare soil in the open, native grass stands to grow and develop. Cool-season grasses tend to form thick, thatchy sods that inhibit natural succession and woody invasion.

Managing WSNG for Hay

Hay cutting of WSNG on reclaimed minelands should be delayed until the third growing season. Hay should be cut no shorter than 8 to 12 inches, and no later than August 1. This is to ensure adequate carbohydrate reserves for overwintering. Gamagrass should be cut no closer than 6 to 8 inches, no later than 60 days before the first hard frost.

Native grasses typically do not require large amounts of fertilizer to maintain hay yields. Periodic liming and fertilizing to soil test is important in maintaining the stand and hay yields. The University of Missouri Extension Centers can provide assistance in soil testing and analysis.

Improper or poor management can weaken a native grass stand and allow undesirable species to invade the site. The manager must remember that removing hay reduces photosynthesis and may deplete the carbohydrate reserves necessary for good winter hardiness and successful spring green-up. Hay removal must be seen as a balancing act between productivity and native grass sustainability. For further information, contact the local USDA Natural Resource Conservation Service Center.

Grazing WSNG

Grazing on reclaimed minesites can be extremely dangerous to WSNG maintenance and productivity. WSNGs should be grazed quickly, leaving 12 inches of stubble no later than September 1 to replenish carbohydrate reserves. Animals should be removed if the soil becomes too wet in mid-summer.

Reclaimed minelands are not as productive as most native soils. Excessive grazing can quickly destroy a good stand of WSNGs. Wildlife carrying capacity, including ground-nesting bird habitat, is quickly reduced. Grazing is a balancing act between productivity and native grass sustainability. Managers must closely monitor grazing of WSNG on reclaimed sites or face complete stand failure. This could result in erosion and exposure of acid-forming materials, causing environmental degradation. For further information, contact the local USDA Natural Resources Conservation Service Center.

Old World Bluestems

Old World Bluestems (OWB) such as caucasian or King Ranch bluestem **should not** be planted. OWBs are aggressive and force out more desirable native species. Once a prairie or WSNG stand is contaminated, the only way to remove OWBs is to kill the entire stand or prairie, which is unacceptable.

Conclusion

Missouri Department of Natural Resources, Missouri Department of Conservation and U.S. Department of Agriculture's Natural Resource Conservation Service staff can discuss with the landowner the particular requirements to establish and manage native grasses on reclaimed minelands. Patience must be emphasized, especially in the first growing season when the WSNGs are small. The landowner must be aware of the unique management requirements, including prescribed burns and closely managed grazing and haying of WSNGs. If the landowner is unwilling to manage the WSNGs as required, then it makes no sense to go to the trouble and expense to plant them. Most failures result from bad management. (For a discussion of WSNGs and reclamation, please review Technical Assistance Bulletin #3.)

For more information call or write:

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